O-22

Session 6) Isotopes in Mars and Venus

Isotopic compositions of Mars' atmosphere by remote-sensing observations: latest results and challenges

Shohei Aoki[1*]

[1] Graduate School of Frontier Sciences, The University of Tokyo.

*Presenting Author Email: shohei.aoki@edu.k.u-tokyo.ac.jp

Thanks to recent observations, understanding of isotopic compositions of CO_2, CO and H_2O in the atmosphere of Mars is progressing. In-situ measurements performed by the NASA Curiosity rover provided accurate values of these isotopic compositions (e.g., Mahaffy et al., 2013), which is useful to discuss long-term variability of the atmosphere (such as atmospheric evolution). Disadvantages of such an in-situ measurement is that we cannot know if the observed values are representative in the whole atmosphere. In contrast, remote-sensing observations by Earth-based telescopes and Mars orbiters can investigate horizontal, vertical, and temporal variations of the isotopic compositions, which is good tracer to study short-term phenomena (such as atmospheric chemistry, sublimation-condensation processes). Recent observations by ground-based telescopes have revealed anomaly in the global map of D/H in water vapor (e.g., Aoki et al., 2015; Villanueva et al., 2015; Alday et al., 2024). Also, recent solar occultation observations by ESA ExoMars Trace Gas Orbiter have extensively investigated the vertical distributions of Isotopic compositions (e.g., Villanueva et al., 2021). One of the unique discoveries from these measurements is that ^{13}C is strongly depleted in CO due to photochemical-induced fractionation in CO_2 photodissociation (e.g., Aoki et al., 2023). In the presentation, a review of theses resent results and challenges of remote-sensing of Isotopic compositions will be discussed.

References::
Alday et al., 2024, https://doi.org/10.1093/mnras/stae1067
Aoki et al., 2015, https://doi.org/10.1016/j.icarus.2015.06.021
Aoki et al., 2023, https://doi.org/10.3847/PSJ/acd32f
Mahaffy et al., 2013, https://doi.org/10.1126/science.1237966
Villanueva et al., 2015, https://doi.org/10.1126/science.aaa3630
Villanueva et al., 2021, https://doi.org/10.1126/sciadv.abc8843